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ABSTRACT

An approach that uses diagrams to illustrate systems of influence is described and proposed as a medium for cross-cultural communication. The approach, entitled System Dynamics, facilitates representation of complex interactions, and has been used in a variety of scientific and professional fields since its inception in the 1950's. Influence diagrams circumvent many of the difficulties of encoding and decoding natural language. The diagrams provide a "language" not biased by culture or history, a non-linear approach to problem-solving and critical thinking, and the clarity and conciseness of graphic representation. In them, the structure and behavior of systems are designated by feedback loops, negative and positive, sketching causal hypotheses and indicating the assumptions underlying any model. (MSE)

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A METALANGUAGE FOR CROSS-CULTURAL BUSINESS COMMUNICATION

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A METALANGUAGE FOR CROSS-CULTURAL COMMUNICATION

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"Do ideas really occur in chains, or is this lineal structure imposed on them by scholars and philosophers?....Logic is precisely unable to deal with recursive circuits without generating paradox and...quantities are precisely not the stuff of complex communicating systems." Gregory Bateson,MIND AND NATURE: A NECESSARY UNITY.

ABSTRACT

The purpose of this paper is to demonstrate the power and flexibility of the influence diagrams used in System Dynamics as a medium of communication, a METALANGUAGE. Influence diagrams, as a form of representation, have been used successfully at International Conferences of the System Dynamics Society to communicate to business, scientific, and non-technical audiences on a wide range of subjects, including the management of natural resources; market analysis;techniques for linguistic simulation; and the etiology and treatment for worker burnout. While English is the language of discourse for all conference papers and sessions, the cross-cultural language which facilitates the exchange of complex concepts and technical principles, and which is, indeed, the common language of this international organization is System Dynamics, particularly the influence diagrams used by System Dynamacists to facilitate the explanation of the text and the relevance of the model.(Wolstenholme and Coyle, 1983).

INTRODUCTION

Many influential thinkers, among them Alfred Korzybski, pointed out the limitations of linear, Aristotelian systems, and the inadequacy of forms of representation, such as the inability of Euclidean and Newtonian systems to deal successfully with electricity; AND THE INADEQUACY OF INDO-EUROPEAN LANGUAGES TO EXPRESS NON-LINEAR CONCEPTS. This paper shows how influence diagrams in System Dynamics TRANSCEND THE CULTURAL BIASES OF NATURAL LANGUAGES; TRANSCEND ARISTOTELIAN BI-POLAR THINKING (either/or; win/lose); and FACILITATE COMMUNICATION BETWEEN PEOPLE IN DIVERSE PROFESSIONS, i.e. engineers and accountants; managers and technicians.

My approach to communication emphasizes praxis, not abstract theory. It uses an approach broadly based on Bertalanffy's General Systems Theory, and Norbert Weiner's cybernetics.

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THE SYSTEMS APPROACH

My study of language and communication is based on a Systems Approach. It posits that the whole is greater than its parts, and emphasizes the connections among the various parts of the process of communication. "Systems thinking is concerned with connectedness and wholeness. By its nature, a systems view of a problem cuts across disciplinary boundaries as defined by many traditional sciences, in a search to understand a problem from an integrated vantage point."(Roberts,1983,5).

Communication is dependent on context, culture, connotation, and COMMITMENT, and closely related to metaphor, mnemonics, and medium, in our efforts to establish a shared meaning between the sender and the receiver. According to I.A. Richards, "the goal of communication is to create a similar mental experience in the other, a goal that can be achieved only when the communicators share a certain degree of past experience."(Littlejohn, 1983,96)). The analysis of communication problems, because of the many variables and complexities and interrelationships involved, benefits greatly from a systems approach, and more specifically from a new branch of System Dynamics called Qualitative System Dynamics.

System Dynamics was developed at MIT in the 1950's. Professor Jay W. Forrester, founder and head of the MIT System Dynamics Group, has written extensively on the subject, applying the principles of systems to problems of management, urban development, and national and international economics. Edward Roberts, professor at MIT, defines System Dynamics as "the application of feedback control system principles and techniques to managerial, organizational, and socioeconomic problems."(Roberts, 1978). Historically, System Dynamics owes much of its philosophy and practice to the analysis of information feedback systems which "originated in engineering experience with simple mechanical and electro-mechanical servo-mechanisms."(Roberts, 1978, 31)

Traditionally, System Dynamics has been defined in terms of quantitative testing of hypotheses, and computer simulations:

"System Dynamics is a method of understanding and improving the complex interactions that characterize biological,

engineering,managerial and social systems. Its primary feature is the application of feedback control principles to real human system problems. A feedback system exists whenever a decision that will affect the future state of a situation is based on the perceived past or present state of that situation. This circular cause and effect chain is called an information feedback control loop....The loops do not function separately, but are coupled together to form complex feedback systems that are whole interacting entities....

SD analysis begins with the identification of the system's objectives and dynamic symptoms, the performance time patterns that prevent goal achievement. Then the operation of the system

is observed and measured (leading to the formulation of a Dynamic Hypothesis). The dynamic hypothesis is QUANTITATIVLEY TESTED (emphasis mine) by writing a set of dynamic equations (the model) that represents the way the system really works....In the next step model time histories are simulated using a SD computer program called DYNAMO, and compared to the real past histories of the real system variables operating under similar conditions."(Fey and Robinson, 1987,2).

System Dynamicists who see the value of making the methodology of System Dynamics more accessible, more easily understood, and more compatible with the purposes and methods used by researchers in the humanities and in the social sciences, urge the adoption of Wolstenholme's definition, which distinguishes the system description and system analysis phases of SD. Qualitative System Dynamics, says Wolstenholme, is:

"A rigorous method for problem identification, system description, qualitative modelling and analyses of change in complex systems; which facilitates and can lead to quantitative modelling and dynamic analysis for the design of system structure and control."(Wolstenholme, 1985, 1052).

NON-LINEARITY AND COMMUNICATION

Non-linearity is the basis of the new New Science concerning communication in terms of cognition and computers. Vico, in LA SCIENZA NUOVA (1744) systematically explored the relationship of languages to culture. Much that has been written about language since then has emphasized its inseparability from culture, context, and connotation. (see Ogden and Richards; Eco; Steiner; Winograd and Flores). To truly understand another language requires a knowledge of the history and culture of the people who use it; this requires much time and effort, and cannot always assure successful decoding and mutual understanding because of the number and subtlety of the variables in interpersonal communication.

Influence diagrams used in System Dynamics can avoid many of the difficulties of encoding and decoding natural languages. An understanding of influence diagrams combines the advantages of a "language" not biased by culture, or history; a non-linear approach to problem-solving and critical thinking; and the clarity and conciseness of graphic representation.

RE-THINKING STRUCTURES: PHILOSOPHY AND PEDAGOGY

Aristotle, said Korzybski, aimed to "formulate a general method for 'all scientific work.' In his day these values were 'two-valued" and 'objective.' While these orientations worked well enough in 350 B.C., the Aristotelian splits between body and mind; space and time; subject and object; are now seen as unsound and delusional. Moreover, the static, objective, solid matter orientations" of earlier science have yielded to the "dynamic, everchanging electronic process orientations."(Korzybski, 1941, xxxiii-xli).

Recent research on left/right brain dominance suggests the value of a non-linear approach to learning. Jerre Levy, a prominent researcher in this field, says that contrary to the popular myth, people use both the right and left brain hemispheres all the time. The late 19th century myth that the right hemisphere was merely a "relay station" had unfortunate consequences for theories of learning behavior. One such consequence was that "standard school curriculums"{sic} only educated the 'logical' left hemisphere." (Levy, 1985). But by 1970 the "reign of the left brain essentially ended," and the scientific evidence now indicates that:

"To the extent that regions are differentiated in the brain, they must INTEGRATE(emphasis mine) their activities. Indeed, it is precisely that integration that gives rise to behavior and mental processes greater than and different from each region's special contribution."(ibid.)

Some researchers argue, in effect, that our educators rely too heavily on a linear, sequential, bits-and-pieces model of learning behavior, aimed primarily at the left hemisphere of the brain. Current researchers conceive of thelearning process as "a spiraling circle rising ever upward to greater levels of complexity and achievement."(Berman, 1985). According to this model, the instructor should try to integrate left/right brain exercises to help the learner use both the analytic and creative sides of the brain. GRAPHIC REPRESENTATIONS SUCH AS INFLUENCE DIAGRAMS ENGAGE THE RIGHT HEMISPHERE, which is superior to the left in "manipulating spatial patterns and relationships," and "appears to process information simultaneously and holistically." (Springer, 1985).

INFLUENCE DIAGRAMS

System Dynamics, as indicated earlier, focusses on the structure and the behavior of systems. The structure and behavior of systems is represented by diagrams called feedback loops. These loops "serve as preliminary sketches of causal hypotheses" and "can simplify the illustration of a model....{they} allow the analyst to quickly communicate the structural assumptions underlying the model."(Goodman, 1980, 5).

A good way to understand positive and negative feedback loops is to think in terms of the classical textbook example of a simple thermostatically controlled heating system. This is a self-regulating or homeostatic system which is goal-oriented and has a control mechanism. The heating unit is activated when the thermostat senses a DIFFERENCE between the desired room temperature and the actual temperature. As the room is heated and reaches the desired room temperature as indicated on the set point of the thermostat, the thermostat turns the heater OFF. Notice that this is a negative feedback loop, indicating the presence of a GOAL and of CONTROL. Positive signs (+) indicate changes in the same direction; negative (-) in the opposite direction. An example of a positive loop is economic inflation or economic depression as represented by an upward or downward spiral that continues in the same direction, with ever-increasing velocity, becoming more and more out of control.

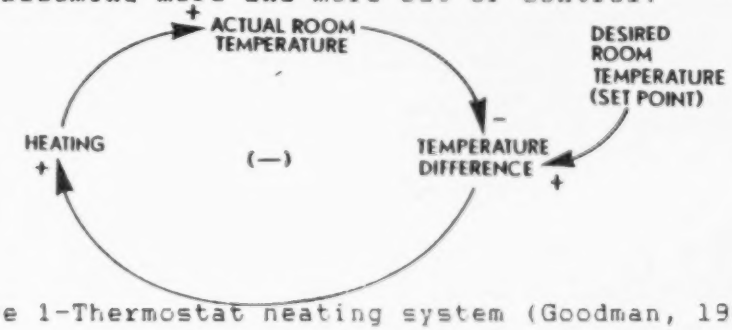


Figure 1-Thermostat heating system (Goodman, 1980,37).

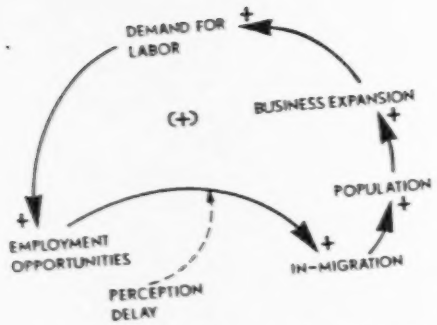
The diagram below represents "simple causal hypothesis relating two feedback loops underlying urban behavior. These hypotheses include:

1. Job availability JA attracts migrants M to the city.
2. New arrivals to the city expand the labor population L.
3. Population absorbs available jobs, decreasing the amount of job availability JA.
4. In the long run, as labor also creates demand for additional goods, urban services and facilities, a further increase in the total number of jobs in the J area comes about.
5. More jobs J increase job availability JA.

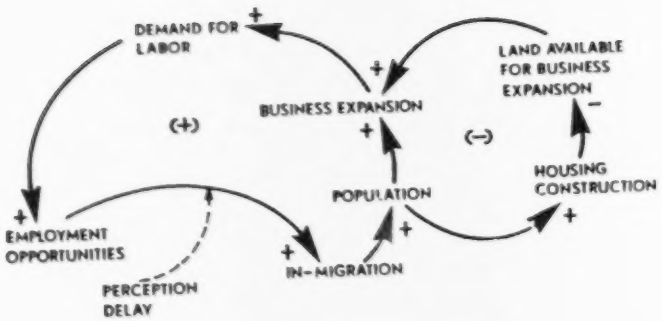
The influence diagrams concerning population growth, medical health, labor force and educated population in urban and rural China, and national development policies for underdeveloped countries are included here to indicate how they are used in papers presented at System Dynamics Conferences, and to show the complexity and gravity of the kinds of problems System Dynamics addresses. A detailed explanation of the loops, which are included in THE PROCEEDINGS OF THE 1985 INTERNATIONAL CONFERENCE OF THE SYSTEM DYNAMICS SOCIETY, are beyond the scope of this paper, though a general summary will be provided.

CONCLUSION

Recent developments in communication technologies, as well as current research in language, cognition, and computers indicate a need for non-linear approaches to understanding how humans acquire language, and how they process information to arrive at meaning. Even the most sophisticated computer methods of translating Japanese into English are sorely limited by the limitations of the syntaxes of the languages used. The experience of the International System Dynamics Society indicates an alternative mode of communication that transcends cultural bias, and Aristotelian bi-polar thinking; the language of influence diagrams are more easily accessible to the part of the brain that processes spatial and holistic relationships, and facilitates communication of people from vastly different cultures, experiences, and professions.



Population-economic growth loop
Goodman, 143



Combined loops Goodman, 145

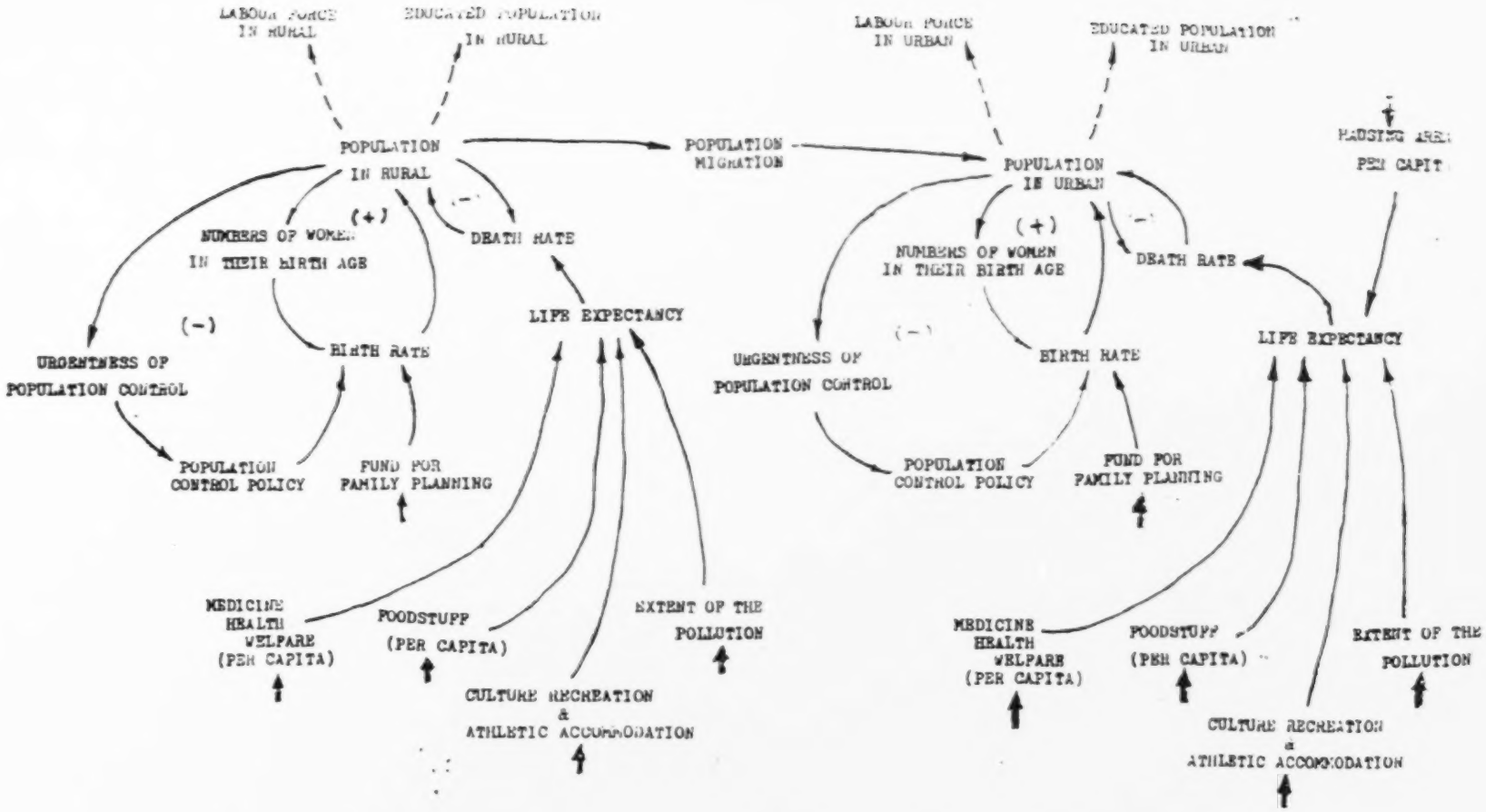


FIG.1 THE CAUSAL FEEDBACK SKETCH OF THE POPULATION SUBMODEL

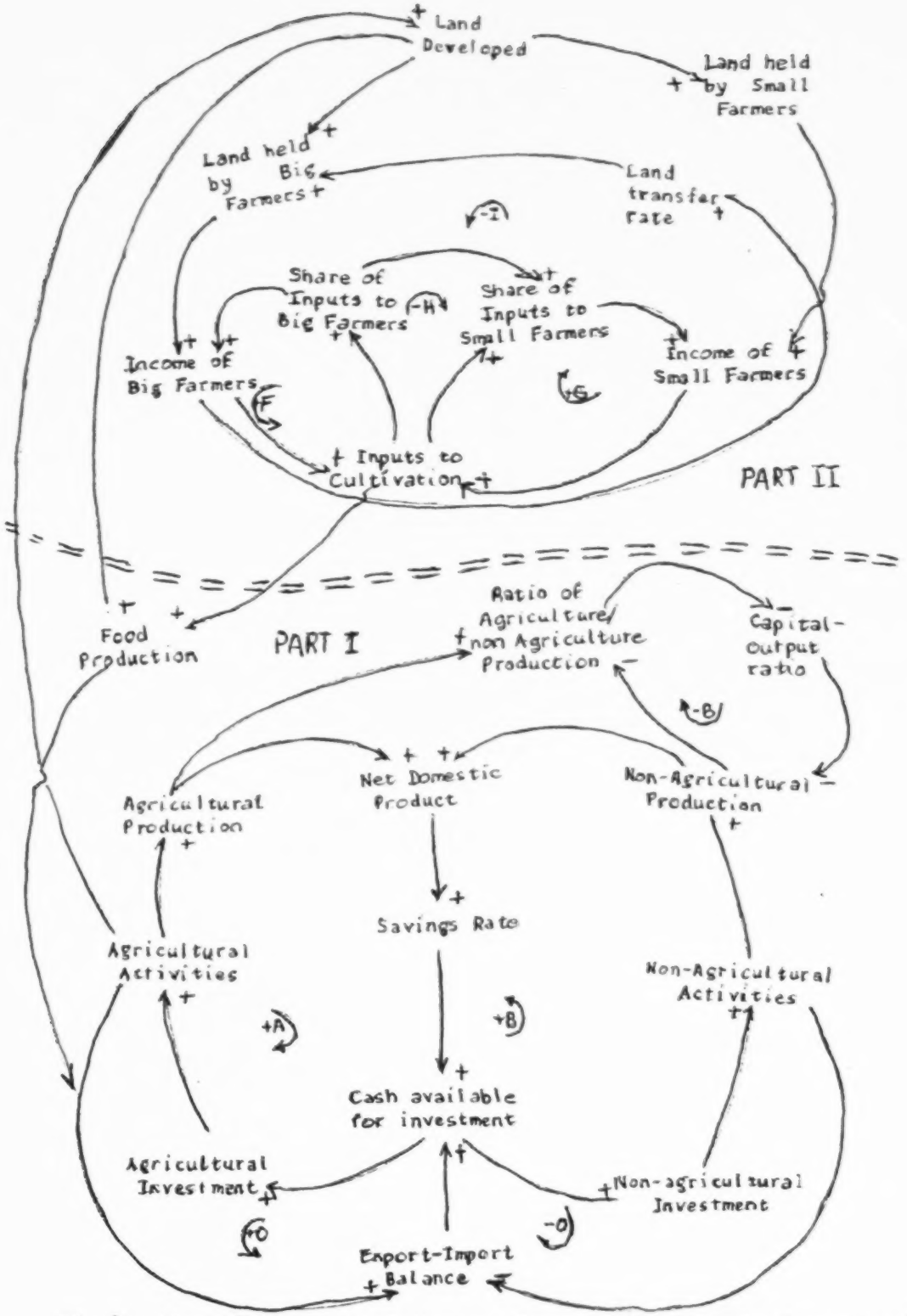


Fig.2: Simplified overall influence diagram of national development model.

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